

REMARKS/ARGUMENTS

Claim 71 is amended by this response. Claims 73-93 are added. No claims are canceled. Accordingly, claims 52 and 56-93 will be pending after entry of this response.

In the latest office action, the Examiner objected to claim 71 as containing a typographical error. Claim 71 has now been amended to correct this typographical error. Accordingly, Applicants respectfully assert that the Examiner's objection to claim 71 has now been overcome.

Embodiments in accordance with the present invention relate to methods of forming multilayered substrates. In accordance with particular embodiments, multilayered substrates may be formed by a controlled cleaving process to separate a film of material from a donor substrate. In such embodiments, a cleave front is initiated at a first energy, and then this cleave front is propagated by subsequent application of a lower energy:

a cleave is initiated by subjecting the material with sufficient energy to fracture the material in one region, causing a cleave front, without uncontrolled shattering or cracking. The cleave front formation energy (E_c) must often be made lower than the bulk material fracture energy (E_{mat}) at each region to avoid shattering or cracking the material. The directional energy impulse vector in diamond cutting or the scribe line in glass cutting are, for example, the means in which the cleave energy is reduced to allow the controlled creation and propagation of a cleave front. (Emphasis added; page 3, lines 20-27)

An express goal of the controlled cleaving processes in accordance with the instant application, is thus to avoid the damage to substrates associated with conventional, uncontrolled cleaving:

the present invention limits energy or stress in the substrate to a value below a cleave initiation energy, which generally removes a possibility of creating random cleave initiation sites or fronts. This reduces cleave damage (e.g., pits, crystalline defects, breakage, cracks, steps, voids, excessive roughness) often caused in pre-existing techniques. (Emphasis added; page 4, lines 21-26)

Sole pending independent claim 52 accordingly recites as follows:

52. A method for forming multilayered substrates, the method comprising:

... releasing the film of material from the donor substrate, while maintaining attachment to the transfer substrate, the releasing comprising, providing a first energy to a selected region of the donor substrate to initiate a controlled cleaving action, and providing a second energy lower than the first energy to sustain the controlled cleaving action in order to free the overlying film from the donor substrate; and coupling the film of material on the transfer substrate to a handle substrate;
transferring the film of material from the transfer substrate to the handle substrate to free the film of material from the transfer substrate while providing the film of material on the handle substrate.

In the latest office action, the Examiner rejected this, and all other pending claims, as obvious under 35 U.S.C. § 103, based upon U.S. Patent No. 5,863,830 to Bruel et al. ("the Bruel patent"). These claim rejections are overcome as follows.

In order to establish a prima facie case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." MPEP 2143. Here, the Bruel patent fails even to suggest all of the elements of the pending claims, and in particular providing first and second energies responsible for initiating and propagating respectively, a controlled cleaving action.

In the Bruel patent, a thin film on a first substrate is transferred to a second ("target") substrate using a separation process. In rejecting the pending claims based upon the Bruel patent, the Examiner has expressly equated a "mechanical grip force" with the second energy of claim 1. Careful inspection of the Bruel patent, however, reveals no legitimate basis for this conclusion.

Nowhere does the Bruel patent teach or even suggest application of a first and second energies. Rather, as indicated by the specific passage relied upon by the Examiner, the Bruel patent simply teaches separation based upon general application of "tearing away" forces:

This support serves to mechanically grip the thin film and exert tearing away forces. (Emphasis added; col. 2, lines 43-44)

Elsewhere, the Bruel patent does indicate that such "tearing away" forces can result from the combination of shearing and tensile forces. (See col. 3, page 46-51).

The term tensile force and shearing force is understood to mean a resultant force. Thus, the tensile and/or shearing force can be unique or can be broken down into a plurality of forces, whose action is combined. (Emphasis added; col. 3, lines 46-51)

Such "tearing away" forces would represent the net sum of the simultaneous application of different tensile and/or shearing forces.

By contrast, the claimed embodiments specifically recite separation based upon the application of first and second energies. Nowhere does the Bruel patent teach, or even suggest, application of first and second energies in the manner claimed.

In spite of the complete failure of the Bruel patent reference to teach or even suggest this element of the pending claims, the Examiner goes on to assert that:

it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to comprehend that the second energy has to be lower than the first energy since by doing so it would maintain the integrity of a rear surface 8 of the overlying film of material 4, i.e. when the second energy is too high and higher than the first energy it would create rough detaching surface 8 after releasing. (Office Action mailed January 18, 2006, page 3, lines 17-22)

The Examiner provides absolutely no evidentiary support for this conclusion.

Certainly, none is present in the Bruel patent itself (the sole reference relied upon by the Examiner), which contains little or no discussion regarding the roughness of the surface after separation.

Moreover, the apparent lack of concern on behalf of the Bruel patent regarding surface roughness, is entirely consistent with its repeated characterization of the separation as a "tearing" process:

- b) transfer of the thin film from the first substrate to the target substrate, said transfer involving both a tearing of the thin film from the first substrate by application to the thin film-first substrate assembly of tearing away forces able to overcome the first bonding energy (Emphasis added; col. 2, lines 21-25)

* * *

- b) separation of the thin film and the first substrate by tearing away the thin film level with the second face and the first substrate (Emphasis added; col. 2, lines 34-36)

* * *

separation of the thin film from the manipulator is obtained by tearing away forces applied to the thin film-manipulator assembly (Emphasis added; col. 2, lines 45-46)

* * *

direct adhesive contacting of the first face of the thin film with the target substrate using a bonding energy higher than the first bonding energy and then the tearing of the thin film from the first substrate. (Emphasis added; col. 2, lines 50-53)

* * *

with a bonding energy E_1 exceeding the bonding energy E_0 between the substrate and the thin film, the tearing away separation stage can take place. (Emphasis added; col. 3, lines 43-45)

This repeated reference to "tearing" by the Bruel patent, certainly reflects the violent, uncontrolled cleaving process that is characterized as prior art by the instant patent application. And, as emphasized at length in the instant specification, such a conventional uncontrolled substrate separation process would result in surfaces exhibiting roughness and defects that are avoided by the controlled cleaving process of the present invention. There is absolutely no teaching in the Bruel patent regarding separation in the controlled manner of the present invention.

Based upon the failure of the art relied upon by the Examiner to teach or suggest every element of the pending claims, it is respectfully asserted that continued maintenance of the pending claim rejections is improper, and these claim rejections should be withdrawn.

Finally, new claims 73-93 are added to the application by the instant amendment. Support for these added claims may be found in the specification as originally filed, at least at page 6, line 29 - page 7, line 5, and in Figure 12. No new matter has been added by the addition of these claims.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Kent J. Tobin', with a long horizontal flourish extending to the right.

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